PATENT ABSTRACTS OF JAPAN

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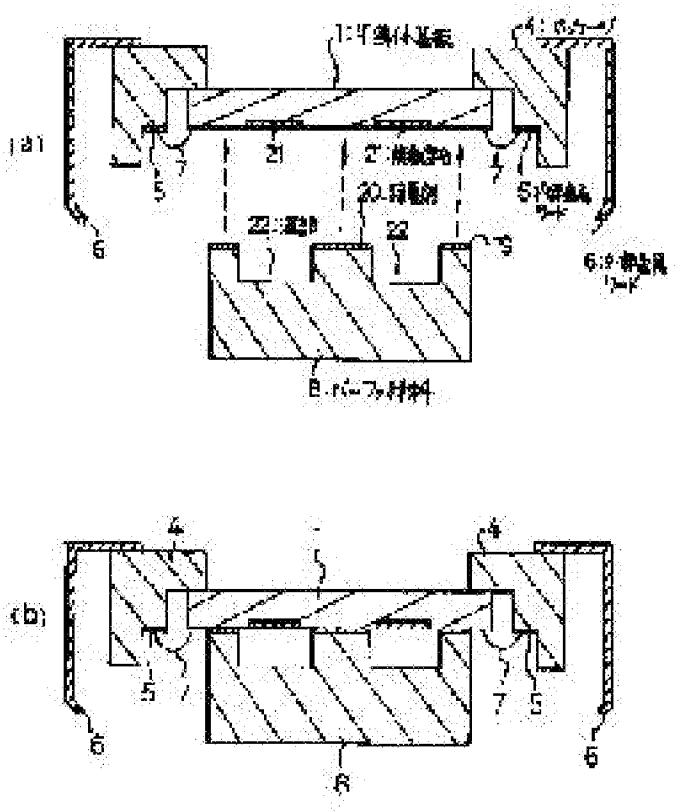
(54) PACKAGING STRUCTURE OF SEMICONDUCTOR DEVICE

(57)Abstract:

PURPOSE: To reduce a mechanical stress, which is inflicted on active parts in the main surface of a semiconductor substrate, in the packaging structure of an infrared image pickup element, wherein a cooling device is secured to the side of the main surface of the semiconductor substrate.

CONSTITUTION: A packaging structure of a semiconductor device is characterized by that in the case groove parts 22 are provided at positions, which correspond to active parts 21 formed in the first main surface of a semiconductor substrate 1, on the main surface 19 of a buffer material 8 and the first main surface 2 of the substrate 1 is bonded on the main surface 19 of the material 8, the structure is constituted in such a way that the parts 21 do not come into contact directly to the material 8. Thereby, a mechanical stress due to a difference in thermal expansion coefficient or the like results is not being inflicted directly on the parts 21 and the reliability of the device is improved.



CLAIMS

[Claim(s)]
[Claim 1]A semiconductor substrate into which active components, such as an infrared detector, are formed in the 1st principal surface, and infrared rays etc. enter from the opposite principal surface, Mounting structure of a semiconductor device has the buffer material for cooling adhered to the 1st principal surface of the above-mentioned semiconductor substrate, provides ditch type structure in the principal surface of buffer material corresponding to the above-mentioned active component, and kept buffer material from carrying out direct contact to an active component.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application]This invention relates to the mounting structure of a semiconductor device, especially the mounting structure of the infrared imaging detector which needs a cooling system.
[0002]
[Description of the Prior Art]Among infrared imaging detectors, since a semiconductor substrate makes infrared rays penetrate, things using a Schottky barrier photodetector have composition which enters light from the principal surface opposite to the semiconductor principal surface in which active devices, such as a detector and a transfer part, are formed. Drawing 2 is a sectional view showing the mounted state of the infrared imaging detector of such rear-face incidence type. In a figure, 1 is a semiconductor substrate which makes the infrared rays which should receive light penetrate, 2 expresses the 1st principal surface (surface) of the semiconductor substrate 1, and 3 expresses the 2nd principal surface (rear face) of the semiconductor substrate 1. Active components, such as an infrared detector and a transfer part which reads the signal from a detector one by one, are formed in the 1st principal surface 2. The metallic wiring which connects the internal metal lead 5 with the active component by which the package in which 4 consists of ceramics etc., the internal metal lead by which 5 was allocated in the inside of a package, and 6 were formed in the external metal lead, and 7 was formed in the 1st principal surface 2 of the semiconductor substrate 1, and 8 are the buffer materials for cooling the semiconductor substrate 1. The glass tube with which 9 constitutes a vacuum dewar, and 10 The metallic wiring inside the glass tube 9, The metallic wiring to which 11 connects the metal lead 6 and the metallic wiring 10 of the package exterior, Metallic wiring for an electrode for 12 to pick out a signal wire from a vacuum dewar into the atmosphere and 13 to connect the metallic wiring 10 and the electrode 12 and 14 are the windows for entering the infrared rays from the outside, for example, are made in germanium etc.
[0003]In the above-mentioned composition, the inside of a vacuum dewar is maintained at a vacuum at the time of operation, the cooling head of liquid nitrogen, and the Joule Thompson condensator or a Stirling cycle condensator is inserted in the crevice of a vacuum dewar, and the semiconductor substrate 1 is cooled through the glass tube 9 and the buffer material 8.
[0004]Drawing 3 shows the layout of the main components formed in the 1st principal surface 2 of the semiconductor substrate 1 shown in drawing 2. The light sensing portion which has the structure which 15 carries out light-receiving absorption of the incidence infrared rays, generates the signal charge proportional to the light-receiving intensity and light-receiving time in a figure, and can accumulate this, and 16 are transfer parts which consist of CCD for transmitting the signal charge by which it was generated in the light sensing portion 15, etc. 17 is FET, as for each FET, the source region is connected to the light sensing portion 15, it is connected to the transfer part 16 and the drain area has an ON-OFF control facility for transmitting the signal charge accumulated in the light sensing portion 15. 18 is an amplifier for amplifying the signal charge transmitted by the transfer part 16 on the voltage proportional to this, and outputting outside.
[0005]Next, how to paste up the above-mentioned infrared imaging detector and the buffer material 8 is explained. Drawing 4 is a sectional view showing the above-mentioned bonding process, drawing 4 a shows the state in front of adhesion, and drawing 4 b shows the state after adhesion. In a figure, 1-8 are

the same as that of the component shown in drawing 2, 19 shows the 1 principal surface of the buffer material 8, and 20 shows the adhesives applied to the 1 principal surface 19 of the buffer material 8. 21 is active parts, such as a detector formed in the 1st principal surface 2 of the semiconductor substrate 1, a transfer part, and FET. It is very easy, the adhesives 20 are applied to the 1 principal surface 19 of the buffer material 8, as shown in drawing 2 b, the 1st principal surface 2 of the semiconductor substrate 1 is pasted, and a bonding process polymerizes the adhesives 20 by the afterbaking.

[0006]

[Problem(s) to be Solved by the Invention]Mounting of the conventional infrared imaging detector is above, and serves as structure in which the 1 principal surface 19 of the buffer material 8 carries out direct contact to the active part 21 of an infrared imaging detector. For this reason, there was a problem that mechanical stress occurs, and that stress acted on the concentration part 21, and was inferior to the reliability as a device by the difference in the coefficient of thermal expansion of the semiconductor substrate 1 and the buffer material 8, etc. at the time of cooling.

[0007]An object of this invention is to reduce the mechanical stress which acts on the active part of an element, without having been made in order to cancel the above problems, and spoiling the cooling efficiency of buffer material.

[0008]

[Means for Solving the Problem]When establishing a crevice of a ditch type in the 1 principal surface of buffer material for cooling and pasting up buffer material and a semiconductor device, reliance was in a semiconductor device concerning this invention so that the above-mentioned ditch type crevice and an active part of a semiconductor device might counter, and it was constituted so that both might not contact.

[0009]

[Function]According to the semiconductor device of this invention, in order that buffer material may not contact directly the active part by the side of a semiconductor device, the mechanical stress added to an active part can be reduced remarkably.

[0010]

[Example]Hereafter, one example of this invention is described about drawing 1. In a figure, 1 is a semiconductor substrate which makes the infrared rays which should receive light penetrate, 2 expresses the 1st principal surface of the semiconductor substrate 1, and 3 expresses the 2nd principal surface. The active components 21, such as an infrared detector, a transfer part, and FET, are formed on the 1st principal surface 2. Metallic wiring for the package in which 4 consists of ceramics etc., and 5 to connect the internal metal lead of a package, for 6 connect an external metal lead, and for 7 connect the internal metal lead 5 with the active component 21, and 8 are the buffer materials for cooling the semiconductor substrate 1. 19 shows the 1 principal surface of the buffer material 8, and 20 shows the adhesives applied to the 1 principal surface 19 of the buffer material 8. In this example, the slot 22 corresponding to the active part 21 is formed on the principal surface 19 of the buffer material 8. Next, if adhesion operation is explained, after applying the adhesives 20 to the 1 principal surface 19 of the buffer material 8, as shown in drawing 1 b, the 1st principal surface 2 of the semiconductor substrate 1 will be pasted.

Then, the adhesives 20 are polymerized with heating etc.

It sets like contact commencement of work, the slot 22 by the side of buffer material is located so that it may correspond to the active component 21 by the side of a semiconductor substrate, and the active

component 22 is kept from contacting the buffer material 8.

[0011]Although the detector explained the linear sensor arranged in one dimension in the above-mentioned example, the effect that a detector is the same also about the area sensor arranged in two dimensions can be acquired.

[0012]

[Effect of the Invention]As mentioned above, since according to this invention it is constituted so that the buffer material for cooling may not contact the active part of a semiconductor substrate directly, the mechanical stress added to an active part can be reduced, and a reliable semiconductor device can be provided.

TECHNICAL FIELD

[Industrial Application]This invention relates to the mounting structure of a semiconductor device, especially the mounting structure of the infrared imaging detector which needs a cooling system.

EFFECT OF THE INVENTION

[Effect of the Invention]As mentioned above, since according to this invention it is constituted so that the buffer material for cooling may not contact the active part of a semiconductor substrate directly, the mechanical stress added to an active part can be reduced, and a reliable semiconductor device can be provided

PRIOR ART

[Description of the Prior Art]Among infrared imaging detectors, since a semiconductor substrate makes infrared rays penetrate, things using a Schottky barrier photodetector have composition which enters light from the principal surface opposite to the semiconductor principal surface in which active devices, such as a detector and a transfer part, are formed. Drawing 2 is a sectional view showing the mounted state of the infrared imaging detector of such rear-face incidence type. In a figure, 1 is a semiconductor substrate which makes the infrared rays which should receive light penetrate, 2 expresses the 1st principal surface (surface) of the semiconductor substrate 1, and 3 expresses the 2nd principal surface (rear face) of the semiconductor substrate 1. Active components, such as an infrared detector and a transfer part which reads the signal from a detector one by one, are formed in the 1st principal surface 2. The metallic wiring which connects the internal metal lead 5 with the active component by which the package in which 4 consists of ceramics etc., the internal metal lead by which 5 was allocated in the inside of a package, and 6 were formed in the external metal lead, and 7 was formed in the 1st principal surface 2 of the semiconductor substrate 1, and 8 are the buffer materials for cooling the semiconductor substrate 1. The glass tube with which 9 constitutes a vacuum dewar, and 10 The metallic wiring inside the glass tube 9, The metallic wiring to which 11 connects the metal lead 6 and the metallic wiring 10 of the package exterior, Metallic wiring for an electrode for 12 to pick out a signal wire from a vacuum dewar into the atmosphere and 13 to connect the metallic wiring 10 and the electrode 12 and 14 are the windows for entering the infrared rays from the outside, for example, are made in germanium etc.
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pasted, and a bonding process polymerizes the adhesives 20 by the afterbaking.

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention]Mounting of the conventional infrared imaging detector is above, and serves as structure in which the 1 principal surface 19 of the buffer material 8 carries out direct contact to the active part 21 of an infrared imaging detector. For this reason, there was a problem that mechanical stress occurs, and that stress acted on the concentration part 21, and was inferior to the reliability as a device by the difference in the coefficient of thermal expansion of the semiconductor substrate 1 and the buffer material 8, etc. at the time of cooling.

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OPERATION

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EXAMPLE

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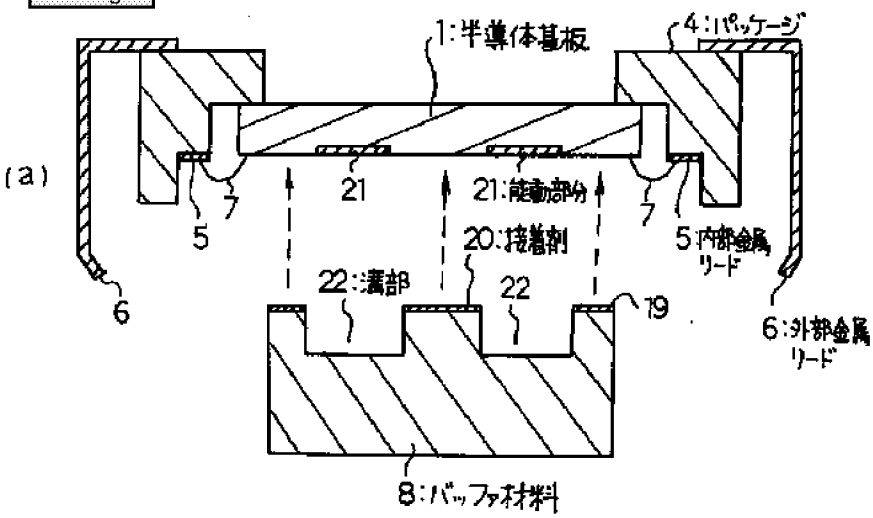
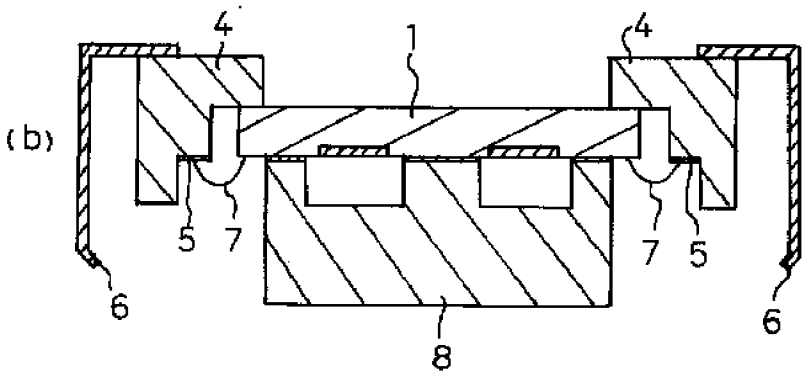
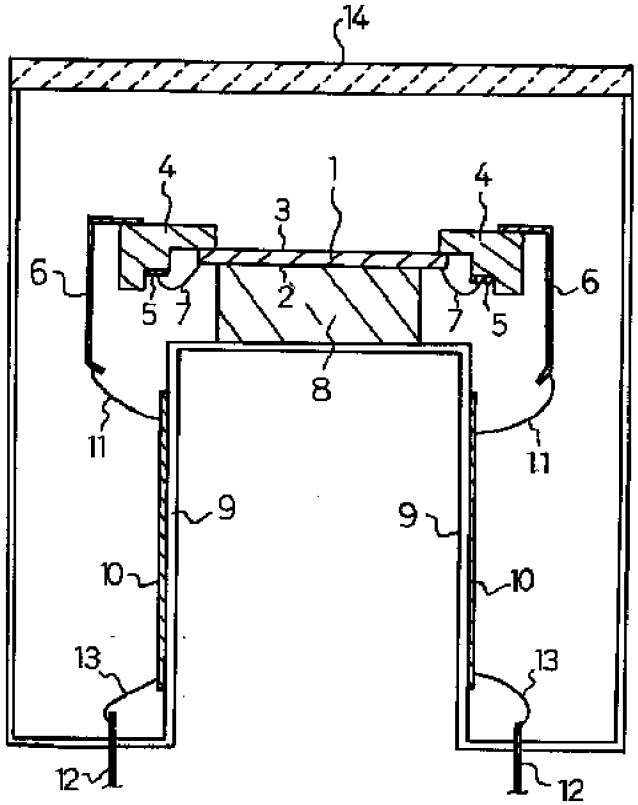
Drawing 1

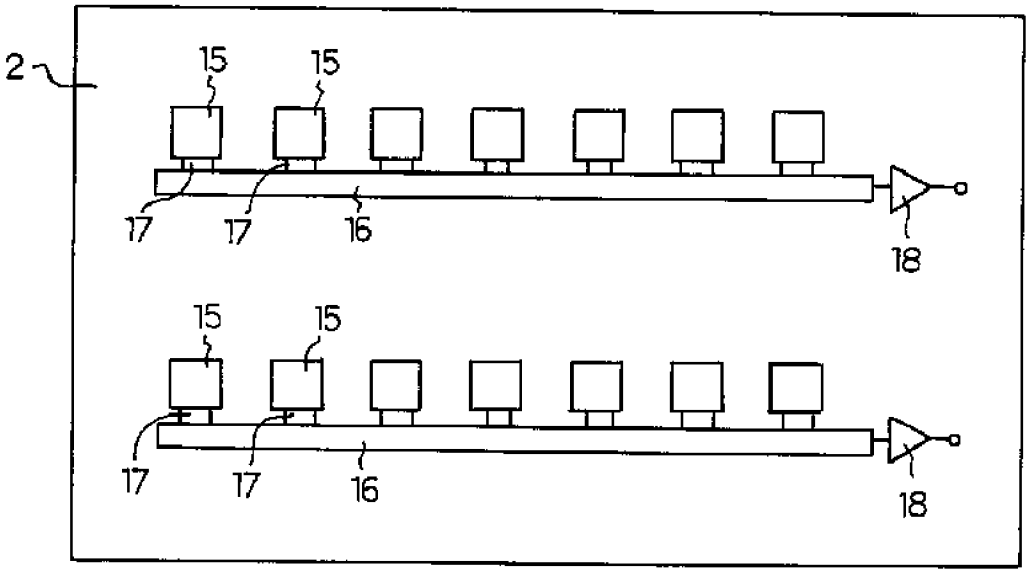




[Drawing 2]



[Drawing 3]



[Drawing 4]